Fastest Growing Mode

- In 2016, the shipping industry transported approximately 130 million containers packed with cargo, with an estimated value of more than $4 trillion.

Statistics

- 2017
  - 183 million (TEU’s) moved annually
  - 6.7 million are in transit now
  - At any point in time, there are about 6,000 containerships active on the world’s seas

Lost at Sea

- 2008-2016
  - World Shipping Council estimates that there were on average 568 containers lost at sea each year, not counting catastrophic events, and on average a total of 1,582 containers lost at sea each year including catastrophic events.
Lost at Sea

- MOL Comfort in the Indian Ocean lost all of the 4,293 containers on board in 2013 – which remains the worst containership loss in history

Types Of Containers

- Dry Freight
- Flat Racks
- Open Top
- Tunnel
- Open side
- Double Door
- Refrigerated
- Insulated / thermal
- Tanks / Tubes
- Cargo Storage Roll
- Half Height
- Car carriers
- Intermediate bulk
- Drums
- Special Purpose
- Swap Bodies

Introduction

OSCL Hong Kong
World’s (current) largest container ship
Length: 1,312’
Beam: 174’
Capacity: 27,413 TEU

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Land Bridge

Stacking

• Bottom container can support 8
• Stack 9 high in ship holds
• Stack 5-6 high on land and above deck on ships

Intermodal Box
TEU Intermodal Containers

- ISO specifications
  - Corner posts take load
  - Corner blocks for rigging
  - Corrugated steel sides & top
  - Doors on one end (or more)
  - Hardwood plywood floor sealed to sides
  - Angle/channel steel support below floor, fork pockets

And It's Big Brother

- The FEU
  - Two TEU's
  - Forty-foot Equivalent Unit, i.e. 40’ long, 8’ wide, 8’ tall

TEU Capacities For Common Container Sizes

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Volume</th>
<th>TEU</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 ft  (6.1 m)</td>
<td>8 ft (2.44 m)</td>
<td>8 ft 6 in (2.59 m)</td>
<td>1,172 cu ft (33.2 m³)</td>
<td>1</td>
</tr>
<tr>
<td>40 ft (12.2 m)</td>
<td>8 ft (2.44 m)</td>
<td>8 ft 6 in (2.59 m)</td>
<td>2,377 cu ft (67 m³)</td>
<td>2</td>
</tr>
<tr>
<td>45 ft (13.7 m)</td>
<td>8 ft (2.44 m)</td>
<td>8 ft 6 in (2.59 m)</td>
<td>3,060 cu ft (86.6 m³)</td>
<td>2 or 2.25</td>
</tr>
<tr>
<td>48 ft (14.6 m)</td>
<td>8 ft (2.44 m)</td>
<td>8 ft 6 in (2.59 m)</td>
<td>3,264 cu ft (92.4 m³)</td>
<td>2.4</td>
</tr>
<tr>
<td>53 ft (16.2 m)</td>
<td>8 ft (2.44 m)</td>
<td>8 ft 6 in (2.59 m)</td>
<td>3,804 cu ft (102.1 m³)</td>
<td>2.65</td>
</tr>
<tr>
<td>High cube</td>
<td>20 ft (6.1 m)</td>
<td>8 ft (2.44 m)</td>
<td>9 ft 6 in (2.90 m)</td>
<td>1,520 cu ft (43 m³)</td>
</tr>
<tr>
<td>Half height</td>
<td>20 ft (6.1 m)</td>
<td>8 ft (2.44 m)</td>
<td>4 ft 3 in (1.30 m)</td>
<td>680 cu ft (19.3 m³)</td>
</tr>
</tbody>
</table>

Stacking Order
Slide 31: Intermodal Box Containers
Packages secured to prevent shifting in any direction

Slide 32: Intermodal Tanks
Container Markings and Data Plates

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Data Plates

• Data Plate
  – A corrosion resistant metal identification plate that is permanently attached to the tank container and readily accessible for inspection.

CSC Plates

• CSC Plate
  – A corrosion resistant metal plate (not less than 200 mm x 100 mm) permanently attached to frame, indicating type, approval number, basic structural data, allowable stacking and racking values, the owner’s structural examination scheme-number and future inspection date (CSC Convention).
Manufacturer’s Data Plate

- Manufacturer
- Country of manufacture
- Date of manufacture (mm-yy)
- ISO tank serial number (XXXX #######-#)

Manufacturer’s Data Plate

- Maximum allowable working pressure (psig/bar)
- Test pressure (psig/bar)
- Tank material
- Tank lining (yes or no)

Manufacturer’s Data Plate

- Heating coils (yes or no)
- Actual shell thickness (in / mm)
- Mild steel equivalent shell thickness (in / mm)
- Mild steel equivalent head thickness (in / mm)

Manufacturer’s Data Plate

- Corrosion allowance (in / mm)
- Maximum gross weight (lbs/kg)
- Tare weight (lbs/kg)
- Total liquid capacity (gal/l)
- Measured water capacity (gal/l)

Manufacturer’s Data Plate

- IMO specification
- US DOT specification
- Certifying agency
- Periodic inspection dates
  - 2.5 year test
  - 5 year test
- Approved Continuous Examination Program (ACEP) Reference Number
Convention for Safe Containers

Approved Continuous Examination Program - ACEP

Country code where the approval for the ACEP was granted

Year when the approval for the ACEP was granted (this is not an expiration date)

ACEP registration number

Markings

- Identification system
  - Owner code
  - Equipment category identifier
  - Serial number
  - Check digit

- Size and type codes

- Operational marks

- Approvals

Name of Material

Marine Pollutant

Special Markings

European Guide (60 is Toxic or slightly toxic) UN Number
End Marking Examples

Can you spot the error?

Common Size Codes

<table>
<thead>
<tr>
<th>Code Length</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 ft</td>
<td>8 ft</td>
</tr>
<tr>
<td>22 ft</td>
<td>8 ft 6 in</td>
</tr>
<tr>
<td>24 ft</td>
<td>&gt;8 ft 6 in</td>
</tr>
</tbody>
</table>

MAWP Codes - Bar (psi)
Non-dangerous liquids
70 0.45 (6.5)
71 1.5 (21.8)
72 2.65 (38.4)

Dangerous liquids
73 1.5 (21.8)
74 2.65 (38.4)
75 4.0 (58.0)
76 6.0 (87.0)

Dangerous gases
77 10.5 (152.3)
78 22.0 (319.1)
79 spare

Country Codes

New Markings

MAWP Codes - Bar (psi)
Non-dangerous liquids
T0 0.45 (6.5)
T1 1.5 (21.8)
T2 2.65 (38.4)

Dangerous liquids
T3 1.5 (21.8)
T4 2.65 (38.4)
T5 4.0 (58.0)
T6 6.0 (87.0)

Dangerous gases
T7 10.5 (152.3)
T8 22.0 (319.1)
T9 spare
Liquefied Compressed Gases

- Specification 51, DOT 51, IMO Type 5
- Currently are T-50 Containers
  - When portable tank instruction T50 is referenced in Column (7) of the 49CFR 172.101 Table, the applicable liquefied compressed gases are authorized to be transported in portable tanks in accordance with the requirements of 49CFR 173.313.

Refrigerated Liquefied Gases

- IMO Type 7
- Currently are T-75 containers
  - When portable tank instruction T75 is referenced in Column (7) of the 49CFR 172.101 Table, the applicable refrigerated liquefied gases are authorized to be transported in portable tanks in accordance with the requirements of 49CFR 178.277.

Formerly Non-dangerous Liquids

- Formerly Type 2 or IM 102 with the following codes
  - 70 or T0 0.45 bar (6.5 psi)
  - 71 or T1 1.5 bar (21.8 psi)
  - 72 or T2 2.65 bar (38.4 psi)
- Are currently

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>1.5</td>
</tr>
<tr>
<td>T2</td>
<td>1.5</td>
</tr>
<tr>
<td>T3</td>
<td>2.45</td>
</tr>
<tr>
<td>T4</td>
<td>2.45</td>
</tr>
<tr>
<td>T5</td>
<td>2.45</td>
</tr>
</tbody>
</table>

Formerly Dangerous Liquids

- Formerly Type 1 or IMO 1 with the following codes
  - 73 or T3 1.5 bar (21.8 psi)
  - 74 or T4 2.65 bar (38.4 psi)
  - 75 or T5 4.0 bar (58.0 psi)
  - 76 or T6 6.0 bar (87.0 psi)
- Notice old T3 or T4 do not fit here at all
- Are currently

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>4</td>
</tr>
<tr>
<td>T7</td>
<td>4</td>
</tr>
<tr>
<td>T8</td>
<td>4</td>
</tr>
<tr>
<td>T9</td>
<td>4</td>
</tr>
<tr>
<td>T10</td>
<td>4</td>
</tr>
<tr>
<td>T11</td>
<td>6</td>
</tr>
<tr>
<td>T12</td>
<td>6</td>
</tr>
<tr>
<td>T13</td>
<td>6</td>
</tr>
<tr>
<td>T14</td>
<td>6</td>
</tr>
</tbody>
</table>
Formerly Dangerous Gases

- Formerly Type 5 / DOT Spec 51
- 77 or T7 10.5 bar (152.3 psi)
- 78 or T8 22.0 bar (319.1 psi)
- 79 or T9 spare

- Are currently
  - T15 10
  - T16 10
  - T17 10
  - T18 10
  - T19 10
  - T20 10
  - T21 10
  - T22 10

Types of ISO Containers

- IMO
  - Type 1
  - Type 2
  - Type 5
  - Type 7

- DOT
  - IM 101
  - IM 102
  - DOT 51
  - New T1-T22
  - T50
  - T75

Intermodal Tanks

SPSI Emergency Response Solutions

Features

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Document Holder

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Intermodal Tank Containers

- Highway
- Rail
- Ship
- Air
- Liquids
- Solids
- Gases
- Cryogenics

Definitions

- Orientation
  - Different parts of the Tank Container are first identified from the overall general perspective usually indicating the location as may apply to a rectangular box (left, front, etc...). Once a plane is identified, then the next focus indicates a more precise location (top, bottom, etc...). Finally the exact defined item is called out.
  - Example: Bottom Front Right Diagonal.

Front / Rear

- Front
  - The end opposite the bottom discharge. If the tank container is top discharge only, the opposite end from the top discharge is the front.
- Rear
  - The end where the bottom discharge is located. If the tank container is top discharge only, the end closest to the top discharge is the rear.

Left / Right

- As the observer faces the rear of the tank container, the left side is on the observer’s left, and the right side is on the observer’s right.
  - Note: When the observer is facing the front of the tank container, this logic does not apply.

Many Styles Of Frames
**Collar Frame**

**Beam frame** - tank part of frame

**Box frame** - tank not part of frame

**Heating Units**

- Viscous materials
- Electrical or steam
- Electrical used during transportation (internal or external)
- 200-240 or 340-480 volts
Heating Coils

External generator

Linings
- Typical rubber, glass, plastic

Refrigeration Units
- Usually not provided with self contained power
- Relies on external power source
- Depends on type of transportation for power
**Materials Of Construction**

- 90% are stainless steel
- Aluminum and steel
- Lined

**Corner Castings**

Containers can be horizontally connected with lashing bridge fittings.

**Low Pressure Tanks**

**IM102 IMO2 Type 2**
IM 102 / IMO Type 2

- **Design pressure**
  - 14.5 psi (1 bar) to 25.4 psi (1.75 bar)
- **Capacities**
  - 5000-6300 gallons
- **Products**
  - Non regulated material, food, alcohols, whiskey, low hazard materials
IM 101 / IMO Type 1

- Design pressure
  - 25.4 psi (1.75 bar) to 100 psi (6.8 bar)
- Capacities
  - 2400-7000 gallons (25,500 liters)
- Products
  - Solvents, flammable liquids, toxic materials, corrosives
End View

Valve box

Certification plates

Overhead Electrical Safety Symbols

Certification plates

Mail box

Unloading valve
Slide 121

10 Foot Container

Slide 122

Slide 123

Slide 124

Different Style Bottom Outlet Valves Found on IM 101 Containers

Slide 125

Relief devices with frangible disks and telltale

Slide 126

Swing bolt manway
**Spec 51, DOT 51, IMO Type 5, T50**

- **Design pressure**
  - 100 psi (6.9 bar) to 500 psi (34.5 bar)
- **Capacities**
  - Up to 5500 gallons (21,000 liters)
- **Products**
  - Liquefied gases (anhydrous ammonia, methyl amines, ethylene oxide) and high toxicity materials

**DOT 51 / IMO Type 5**

- **T50**
  - 20 foot container
    - 4500-6400 gallons
  - 40 foot beam container
    - 10,600 gallons
  - Specialized containers as small as 50 gallons (pyrophoric liquids)
  - Shell thickness 0.772 (19.6 mm)
  - MAWP – 261-493 (18-34 bar)

**Typical Gas Container**

- Sun Shield
- Pressure relief
- Bolted Manway
- Valve box
Type 7 or T75

- Big thermos bottle
- Vacuum jacketed and thermal insulation
- Have a “One Way” holding time
- Designed for specific cryogenic

T75

- 20 or 40 foot long
- 2000-14,300 gallons (8000-5400L)
- MAWP 150, 250, 320 psig
- Complex fittings
- Designed to vent
- On ship vent valves closed
- Stored on deck only
- Usually stern of the vessel

T75

- May also have
  - Controls for filling
  - Internal coils to raise temperature for unloading
  - Flow gauges
  - Vacuum connection / gauges
Tube Trailers

- Multiple individual tanks
- One product
- Products
  - Compressed or liquefied gases
  - helium, hydrogen, oxygen, anhydrous hydrochloric acid

Tube Trailers

- Multi-tube configuration, these transport bulk non liquefied compressed gases
- Pressures up to 5000 psi
- 20 or 40 foot
Bad Day

• Korea
• AHF
• No PPE
• Loading hose disconnected?
• 5 fatalities
• 3000 plus treated